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ABSTRACT

A model of cognitive operations that children use in reading and comprehending a sentence was tested by using Sternberg's independent-process analysis on 64 second and fifth graders who were either high- or low-ability readers. Three specific component processes were examined: a decoding process, a word meaning process, and a comprehension process. Subjects read sentences constructed in a manner that systematically varied the factors hypothesized to affect each component process. The effects of these factors were measured by pronunciation errors, word definition errors, sentence reading time, and sentence comprehension tasks. In general, the data showed that the independent-process model was a reasonably good descriptor of high-ability readers, but that low-ability children followed a more complex and interrelated model. (Author/RAI)

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A Cognitive Model of Reading for Elementary School Students

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Sentence Reading and Comprehension:

A Cognitive Model

There has been considerable debate in the literature on reading about two reading models: the Hypothesis Testing models and the Information Processing models. The Hypothesis Testing position explains the reading process primarily in terms of generating hypotheses about the printed material, with relatively little input from the visual text itself. The reader uses knowledge of the topic, preceding context, and knowledge of sentence constructions, etc., to form hypotheses about the meaning of a sertence or passage. Only minimal information from the visual text (e.g., individual letters in words) is sampled and processed. As long as minimal sampling is in general agreement with the predicted meanings of the word or sentence, no further in-depth processing of the visual material is needed (Hochberg, 1970; Goodman, 1970).

The second category of reading models view reading as primarily a task of direct processing of visual print. Such models conceptualize the reading process as a series of information-processing stages (Mackworth, 1972; McConkie and Rayner, 1976). Though they may overlap in execution time, each process functions as a discrete operation. For example, if decoding and word meaning are portrayed as two independent stages in reading, then it is assumed that word meaning plays no role in the decoding process and vice versa. Since little communication exists between processes, forming a hypothesis (e.g., about a word's meaning based on its orthographic characteristics) is not an apt characterization of the

intellectual functions that take place during reading. A more accurate description of the reading process, according to this view, involves the direct processing of visual print through a set of independent operations. However, unless the functional independence of each stage in the information processing model is demonstrated, a clear distinction between the two models is lost.

Sternberg (1969) suggested a method for testing the independence of processing stages. Each process is linked to a unique set of factors and performance measures. Process-independence exists when the operation of each process is shown to be influenced only by the set of factors directly associated with it --that is, the performance measures show no main effects or interactions of factors representing different processes. Mason (1977) used this approach to study how elementary school children read individual words. She tested the relationship between two presumably independent processes: a decoding process and a semantic match process. Her results did not support the independence of these processes, as factors which were linked to the semantic match process, such as frequency and concreteness, were found to affect the decoding process. Certain factors that Mason did not explore may have affected this outcome. In particular ability level of the reader could be an important variable. It may be that poor readers operate more like a Hypothesis Testing model whereas good readers follow an Information Processing model.

In the current study an information processing model of sentence reading was developed and tested. It was assumed that the activity of reading and understanding a sentence is carried out by the operations of

three basic independent processes: decoding, word meaning, and sentence comprehension. In the decoding process words are converted from a visual to a phonetic representation. Two factors were expected to influence this process: number of syllables and "decodability" or regularity of phonic patterns. The decoding process was examined through pronunciation errors. In the word meaning process words in the sentence are associated with their stored meanings. Presumably this match is the result of a search process through semantic networks; the search being guided by phonetic information, syntactic cues, and context. Two factors were expected to influence this process: word frequency and word concreteness. The effect of these factors was measured through word definition errors. In the sentence comprehension process meanings of the individual words are related, perhaps through a propositional format (Kintsch, 1974) to form an understanding of the sentence. Two factors expected to affect this process were reversibility (whether the subject and object were semantically interchangeable) and sentence length. Two performance measures were used to examine the process: sentence reading time and sentence understanding errors. The model is illustrated in Figure 1. For process-independence to be demonstrated, performance measures should be affected only by those factors directly linked to them. For example, "decodability" should affect the decoding process, but not the word meaning process.

Insert Figure 1 about here

Method

Subjects

A total of 64 students participated in the study. Equal numbers of females and males, second and fifth graders, and high and low ability readers, were selected from two schools in two northern California cities.[1] Ability level was determined on the basis of classroom reading group assignment, scores on the reading sections of a school-administered achievement test[2], and experimenter testing on a graded word list (a portion of the Interactive Reading Assessment System; Calfee and Calfee, 1977). High ability students scored between the 60 to 80% ($\bar{X}$=75%) level on the standardized test, were in the top reading groups in their class, and read from the graded word list at a level higher than their grade. Low ability students scored between the 20 and 40% ($\bar{X}$=25%) level on the standardized test, were in the bottom reading groups in their class, and read from the graded word list at a level below their grade.

Materials

Sentences were constructed from words that met the combined conditions of the two decoding factors, the two word meaning factors, and the two sentence comprehension process factors. Each sentence had a subject-action-object (SAO) sequence. Long sentences contained an extra adjective and a three word prepositional phrase. Reversible sentences contained an interchangeable subject and object. The subject and object in each sentence were "target" nouns which met the same set of word conditions (e.g., both were one syllable, easy decodable, high frequency, concrete words). Easy decodable words had only one vowel per syllable

or one vowel plus a silent "e", regular vowel patterns in each syllable (i.e., $C\breve{V}C$, $C\bar{V}$, $CV\bar{C}e$) and syliables which contained isolated single consonants (e.g., as in "tiger" or "kidnap"). Hard decodable words had difficult vowel patterns in at least one syllable. Examples of such patterns are dipthongs, and vowels and vowel digraphs which do not correspond to commonly taught generalizations, such as the $C\breve{V}C$ or $\bar{V}\bar{X}$ rule. Frequency was determined by the total word frequency count of Carroll, Davies, and Richman (1971). The mean frequency for high frequency words was 521.3 per million, with a range from 53 to 5486 per million. The mean frequency for low frequency words was 19.2 per million, with a range from 0 to 48 per million. Concreteness was determined by combining the criteria suggested by Gorman (1961); Paivio (1965); Spreen and Schultz (1966); Paivio, Yuille, and Madigan (1968). Two major criteria for concrete words emerged: direct reference to sense experience and specificity of referent class (the similarity of class exemplars). Using this criteria, four adults independently rated potential experimental words as concrete or abstract. Words rated by all four judges to be either clearly concrete or abstract were used. The other words in the sentences came from either the Dolch Basic Sight Vocabulary (1936), the Harris-Jacobson Core Word Lists for First Grade (1972) or the California first grade speller (Kottmeyer and Claus, 1968). The sentences appear in the Appendix.

Words shown to the subjects were typed on 3 x 5 cards. Sentences appeared on 4 x 6 cards. In the comprehension task subjects were shown four black and white schematic drawings and asked to point to the one

which illustrated the meaning of the sentence. Sample pictures are shown in Figure 2. Individual pictures measured 2 3/4 by 3 1/2 inches (7 x 9 cm). Serial order of the "correct" picture was randomized through the picture sets. For each sentence, four pictures were given: the correct one; two pictures which had one incorrect element (e.g., the wrong representation of the subject or object, or a reversal in roles between subject and object); and one picture with two incorrect items.

Insert Figure 2 about here

Procedure

In each session the children were tested on four randomly selected sentences--two long and two short sentences. Each testing session consisted of the following tasks in order: 1) individually pronouncing all words which would appear in the four sentences; 2) defining each of the nouns and verbs (prompts to elicit responses and elaborations, e.g., "tell me more" were used); 3) training on any of the words missed in Steps 1 and 2 (Decoding training consisted of the experimenter slowly pronouncing the word as the subject looked at it. Vocabulary training consisted of the experimenter giving a verbal definition of the word and questioning the child to make sure it was understood.); 4) re-testing and re-training until the child gave two successful pronunciation/definitions in a row. 5) reading each of the four sentences aloud; 6) pointing to the picture (1 out of 4) which showed what the sentence meant.

Approximately eight 20-minute testing sessions were needed. In

addition, one pre-session was devoted to familiarizing the subjects with the tasks and experimenter. In this session subjects practiced the tasks outlined above with two sample sentences.

Design

The sentence and word factors formed the within subjects portion of the design. There were four word factors: Syllables, Decodability, Concreteness, and Frequency. There were two sentence factors: Length and Reversibility.

Between subjects factors were: Grade, Sex, Ability, School, Sentence Block, and Replication. The sentences were divided into two balanced sets of long and short sentences with the same target words. A replication factor was introduced to control for idiosyncratic sentences. The total design was a $2^4 \times 2^2 \times 2^6$ confounded blocks, factorial design. A total of 128 sentences were constructed to meet design requirements. Due to the replication and blocking factor, each subject read a total of 32 sentences. (Refer to the Appendix.)

Scoring

Pronunciation errors were determined against Webster's New World Dictionary (1976). Scoring was based on the number of times a subject mispronounced a word before correctly pronouncing it twice in a row.

Word meaning errors were also determined by Webster's Dictionary. Scoring was based on the number of incorrect definitions a subject gave before correctly defining a word twice in a row.

Sentence reading time was measured with a stopwatch to half-second accuracy. Sentence understanding errors occurred when a subject chose

an incorrect picture as representing the sentence's meaning.

Results

The data were treated by linear contrasts within an analysis of variance. A significance level of .05 was selected. All significant effects through two-way interactions are reported for each performance measure. The main effects appear in Table 1. School, Sex, Replication, and Sentence Block did not appear as important sources of variance and will not be reported.

Insert Table 1 about here

Pronunciation Error Analysis

Analysis of pronunciation errors for between subjects factors revealed significant main effects of Grade $F(1,53)=84.4$, $p < .001$ and Ability $F(1,53)=63.1$, $p < .001$. There was a significant interaction between Grade and Ability $F(1,53)=27.1$, $p < .001$.

Analysis of within subjects and within/between subjects factors revealed several results which supported the information-processing model of reading. There were significant main effects of Syllables, $p < .001$ and Decodability, $p < .001$. Significant interactions included: Syllables x Grade, $p < .001$, Syllables x Ability, $p < .05$; Syllables x Decodability, $p < .001$, Figure 3; Decodability x Grade, $p < .001$; and Decodability x Ability, $p < .001$.

Insert Figure 3 about here

Other significant results were the main effects of Concreteness, $p < .001$ and Frequency, $p < .001$ and the following interactions: Frequency x Syllables, $p < .001$, Figure 3; Frequency x Decodability, $p < .001$, Figure 4; Frequency x Ability $p < .05$, Figure 5; Concreteness x Grade, $p < .001$; Concreteness x Ability, $p < .001$, Figure 5; and Concreteness x Frequency, $p < .001$.

Insert Figures 4 and 5 about here

Word Definition Error Analysis

Analysis of word definition errors for between subjects factors revealed significant main effects of Grade $F(1,53)=42.6$, $p < .001$ and Ability $F(1,53)=27.0$, $p < .001$.

In support of the information-processing model are the significant main effects of Concreteness, $p < .001$, Frequency, $p < .001$; and the following interactions: Concreteness x Grade, $p < .001$; Concreteness x Ability, $p < .001$, Concreteness x Frequency, $p < .001$, Frequency x Grade, $p < .001$, and Frequency x Ability, $p < .001$.

Other significant results are the main effects of Syllables, $p < .001$ and Decodability, $p < .001$ and the following interactions: Syllables x Concreteness, $p < .05$, Syllables x Frequency, $p < .001$, Syllables x Decodability, $p < .001$; Decodability x Frequency, $p < .001$; and Decodability x Concreteness, $p < .001$.

Sentence Reading Time Analysis

Analysis of sentence reading time for between subjects factors

revealed significant main effects of Grade $F(1,53)=99.4$, $p< .001$ and Ability $F(1,53)=85.9$, $p <.001$. There was a significant interaction between Grade and Ability $F(1,53)=58.7$, $p <.001$

As predicted by the information-processing model there were significant main effects of Reversibility, $p <.05$; Length, $p <.001$; and Syllables, $p <.001$ (as syllables reflect length).

Other significant results were the main effects of Concreteness, $p <.001$ and Decodability, $p <.01$, and the following interactions: Concreteness x Grade, $p <.05$; Concreteness x Ability, $p <.01$, Figure 6; Syllables x Decodability, $p <.05$, Syllables x Frequency, $p <.01$, and Reversibility x Syllables, $p <.05$.

Insert Figure 6 about here

Sentence Understanding Error Analysis

Between subjects results for sentence understanding errors revealed significant main effects for Grade $F(1,53)=5.8$, $p <.05$ and Ability $F(1,53)=12.5$, $p <.001$.

In support of the information-processing model was the significant main effect of Reversibility, $p <.01$.

Other significant results were the interactions of Reversibility x Concreteness, $p <.001$; Length x Syllables, $p <.05$; Length x Decodability, $p <.001$; Concreteness x Ability, $p <.01$, Figure 6; Concreteness x Frequency, $p <.05$ and Syllables x Decodability, $p <.01$.

Discussion

Decoding Process

As predicted by the model in Figure 1, Syllables and Decodability significantly affected pronunciation errors. Not predicted by the model were the significant effects of Frequency and Concreteness. High frequency words were pronounced with fewer errors than low frequency words. Likewise concrete words incurred fewer errors than abstract words. The Concreteness effect, however, was largely attributable to either second graders ($F=14.4$, $p < .001$) or low ability readers ($F=13.0$, $p < .001$). Several researchers have found this same effect of concreteness. On the basis of his work with dyslexic (brain-damaged) patients, Richardson (1975a, 1975b) suggested that such readers can respond to the printed configuration of a high-imagery word with a mental image that they can subsequently name. Jorm (1977), who found the same effect with poor readers, pointed out (after Kintsch, 1974) that the effect may be due to the enhanced relations with other words that high-imagery words provide, rather then specific mental pictures which they evoke. In either case, Jorm attributes the differential effects of high-imagery words on poor and good readers to the type of reading strategy they use--phonics for good readers and whole word reading for poor readers. The present study suggests that good readers systematically decode words whereas poor readers, with minimal decoding skills, attack a word by a combination of attempts to sound it out and "guess" it--with "guesses" being shaped by whatever cues are deduced from the word, e.g., the beginning letter. Poor readers are trying to hear something they can recognize as a word.

Since high frequency, concrete words are more likely to be available in memory, they are more likely to be guessed. Indeed, the Concreteness x Frequency interaction supported this interpretation with concrete, high frequency words causing considerably less errors than other combinations ($F=16.6$, $p < .001$).

The effect of Frequency on pronunciation errors was substantial ($F=89.2$, $p < .001$). It seems likely that certain short, high frequency words were recognized as sight words by the readers. That is, quick "template" matching allowed these words to be pronounced without detailed phonic processing. That such words have templates is suggested by the interaction between Frequency and Syllables ($F=41.0$, $p < .001$) in Figure 3. Short, high frequency words incurred few pronunciation errors, in contrast to long, high frequency words and short, low frequency words.

It also seems likely that we store templates for letter combinations that represent regular, frequently occurring phonic units (e.g., "og" as in "dog", "hog", "log", or "sh" as in "ship" or "wish"). In a short one-syllable word, the recognition of a letter combination template (in particular a vowel-consonant template) and subsequent blending with any additional letters, would easily lead to correct word pronunciation. Such an interpretation is suggested by the Syllables x Decodability interaction ($F=21.1$, $p < .001$) in Figure 3. Short, easy decodable words have significantly fewer pronunciation errors than do either short, hard decodable words or long, easy decodable words.

The data suggest a two-stage decoding process. First, the input word is scanned for a template match. Such a match is likely to occur if the

word is either of high frequency or contains a frequently occurring letter-sound unit. If a match for the entire word is found, no further decoding is required. If a match is found for only a portion of the word (e.g., a high frequency letter combination) or if no match is found, the word proceeds to the second stage. If a partial match was found, little additional processing is required (i.e., blending of any remaining letters). Otherwise, the word must be systematically decoded using stored letter-sound correspondences. Such a process is illustrated in Figure 7. The hardest words to decode, then, are ones that either lack stored templates or are hard to decode due to irregular spellings, which agrees with the Frequency x Decodability interaction ($F=34.2$, $p < .001$) in Figure 4.

Insert Figure 7 about here

Such a view of the decoding process can account for the unexpected Frequency effect in a manner compatible to an information-processing model. Frequency affects the decoding process because high frequency words are likely to have stored tamplates. The effect does not reflect an interaction with the word meaning process. That is, readers are not using a word's meaning to decode it. The original information-processing model could be modified to include a two-stage decoding process, as shown in Figure 8.

Word Meaning Process

As predicted by the information-processing model, both Concreteness ($F=280.0$, $p < .001$) and Frequency ($F=459.4$, $p < .001$) had highly

significant main effects on word meaning errors. Abstract words were especially difficult for low ability readers (Concreteness x Ability, $F=23.2$, $p < .001$) and second graders (Concreteness x Grade, $F=14.8$, $p < .001$). Low frequency words also caused more problems for young readers (Frequency x Grade, $F=24.7$, $p < .001$) and low ability readers (Frequency x Ability, $F=14.5$, $p < .001$). As expected, abstract, low frequency words were the hardest to define for all groups (Concreteness x Frequency, $F=28.7$, $p < .001$).

The model did not predict the effects of Syllables ($F=16.9$, $p < .001$) and Decodability ($F=16.6$, $p < .001$). Though these effects are substantially smaller than those of Concreteness and Frequency, that they are significant at all is puzzling. Why should the orthographic features of a word affect a subject's ability to define it? With frequency and concreteness controlled, why should easy decodable words cause fewer meaning errors than hard decodable words?

Consider how the meaning of the word "cap" is accessed. We enter a mental lexicon to "look up" the word "cap." "Cap" may be located in several semantic networks, including one dealing with articles of clothing. The path we would follow in locating "cap"in the Dictionary could be random, or directed by context cues of preceding written material. However, suppose that before entering the lexicon "cap" is recognized as a common spelling unit (CVC). We can easily list strings of words with similar letter-sound characteristics (e.g., cap, lap, nap, sap, map). Such words could be stored together in memory in spelling lists, in addition to their storage location in the lexicon. There may even be a path from the

spelling storage location to the lexicon listing. If this is the case, such words have an advantage over irregularly spelled words in securing meanings; the more pathways one has with which to enter the lexicon, the greater the likelihood that a meaning will be located. Such an idea is not new, and is similar to the attribute theory of memory or the multiple coding theory.[3] While the results of the present experiment are not interpreted as strong evidence for the multiple coding theory, the results are consistent with this hypothesis. The results suggest that the word meaning process has at least two stages. The first stage is recognizing a word as one which is stored in our mental lexicon; this stage is affected by factors like decodability, syllables, and frequency. If the word is recognized we can proceed to stage two and identify its meaning. Identification of meaning is affected by factors like frequency and concreteness. If the word is not recognized, we terminate the search through semantic networks, as shown in Figure 8.

Sentence Comprehension Process

Two factors were predicted to affect comprehension: Reversibility and Sentence Length. Reversible sentences had more comprehension errors than nonreversible sentences ($F=10.5$, $p < .01$); but Length was not a significant factor. Apparently the addition of one adjective and a short prepositional phrase to a sentence does not hinder comprehension. This may be because such additions increase either the ease with which the reader can visualize the sentence's meaning or the associational links between words (Kintsch, 1974). That is, "The little pet rubs the son on the leg," may evoke either a quicker mental picture or better associations

than, "The pet rubs the son." That imaging plays a role in comprehension for some readers is suggested by the strong effect of Concreteness on Sentence Reading Time ($F=28.5, p < .001$). However, as discussed previously, this may be due to the stronger inter-associations of concrete words rather than the actual formation of mental pictures. The Concreteness x Ability interactions for both Sentence Understanding Errors ($F=4.5$, $p < .05$) and Sentence Reading Time ($F=10.3$, $p < .01$) in Figure 6 indicate that low ability readers are more affected by concreteness than high ability readers. Presumably, low ability readers, perhaps because they rely more on imaging the meaning of a sentence in achieving comprehension, have fewer available comprehension strategies to help them with abstract sentences.

The training procedure in the experiment ensured that subjects could both decode and define each word in the sentence. Overall, subjects made few comprehension errors. The errors that were made tended to reflect the Reversibility effect and the Concreteness x Ability effect discussed above. In general, it appears that if a child has difficulty comprehending a fairly straightforward syntactic sentence (e.g., Subject-Action-Object) his problem is caused by either poor decoding skills or a weak vocabulary, rather than by some mental integration problem.

Insert Figure 8 about here

A Refined Model

Results of the current study indicate that as readers become more

skilled their reading style increasingly resembles that of the information-processing models. Specifically they act like the model in Figure 8. The well-developed decoding skills of good readers make direct processing of the text an expedient procedure. While such readers may occasionally "guess" at a word based on sentence or story context, such "guesses" arise out of maturity rather than need. In contrast, poor readers guess as often as possible about the content of printed material, rather than processing it directly. Presumably this is because they lack adequate decoding skills.

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Footnotes

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[1]Both schools are located in low to middle income neighborhoods and have a racially mixed student body. (Although ethnicity was not a variable in this experiment, an attempt was made to reflect the ethnic balance of the schools in selecting subjects.)

[2]California Achievement Test and Comprehensive Test of Basic Skills

[3]For details see discussion in Melton and Martin, 1972.

Table 1

Main Effects[ab]

Source	Word Pronunciation Errors F	Mean	Word Definition Errors F	Mean	Sentence Understanding Errors F	Mean	Sentence Reading Time F	Mean
Syllables	38.8***		16.9***		---		14.7***	
One		.43		.51				6.54
Two		.54		.42				9.39
Decodability	123.8***		16.6***		1.67		11.6**	
Easy		.31		.43				5.90
Hard		.66		.50				6.63
Concreteness	38.8***		280.0***		3.00		28.5***	
Concrete		.43		.30				5.63
Abstract		.54		.63				6.89
Frequency	89.2***		459.***		4.00		---	
High		.37		.18				
Low		.60		.74				
Reversibility					10.5**		7.0*	
Non-reversible						.10		6.63
Reversible						.14		5.90
Length					---		167.0***	
Short								4.84
Long								7.68

[a] $F(1,55)$

[b] F ratios less than 1.00 are not reported

*$p < .05$

**$p < .01$

***$p < .001$

Figure Captions

Figure 1. Factors and performance measures used to test an information-processing model of sentence reading.

Figure 2. Sample pictures used in the comprehension task: The bus hits the car; The pretty garden has a cactus in the back; The old bum hits the hag with a shoe; The cow finds the mouse.

Figure 3. Frequency x Syllable and Syllable x Decodability.

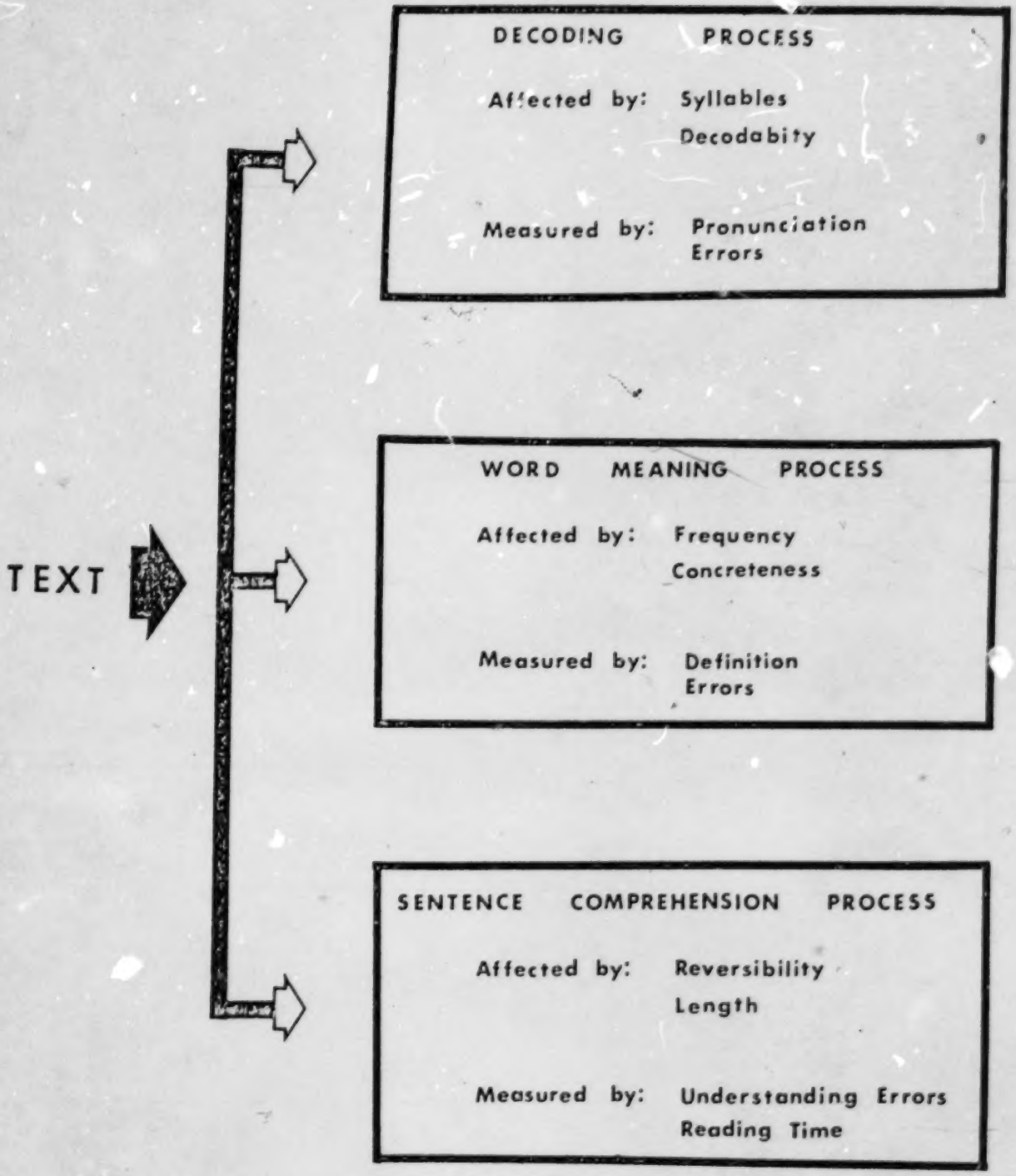
Figure 4. Frequency x Decodability.

Figure 5. Frequency x Ability and Concreteness x Ability.

Figure 6. Concreteness x Ability.

Figure 7. Two stage model of the decoding process.

Figure 8. An information-processing model of sentence reading.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WORD MEANING PROCESS
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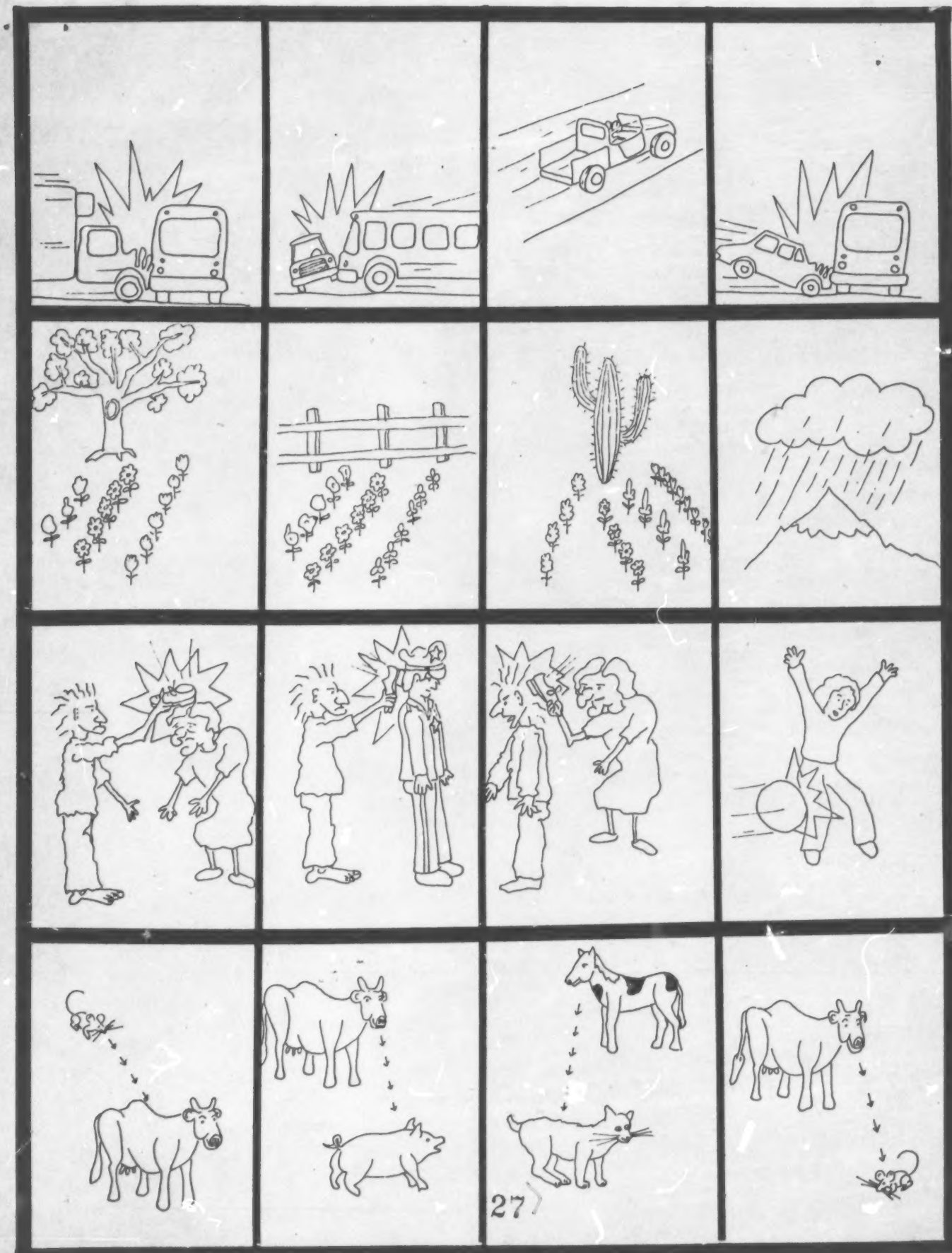
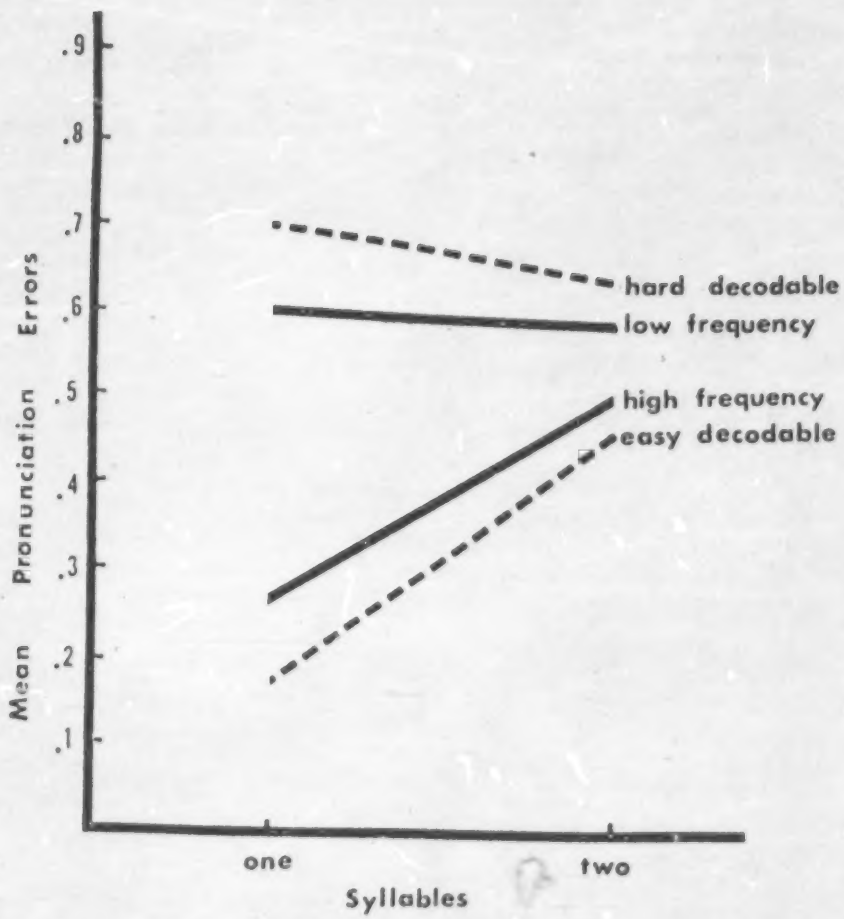
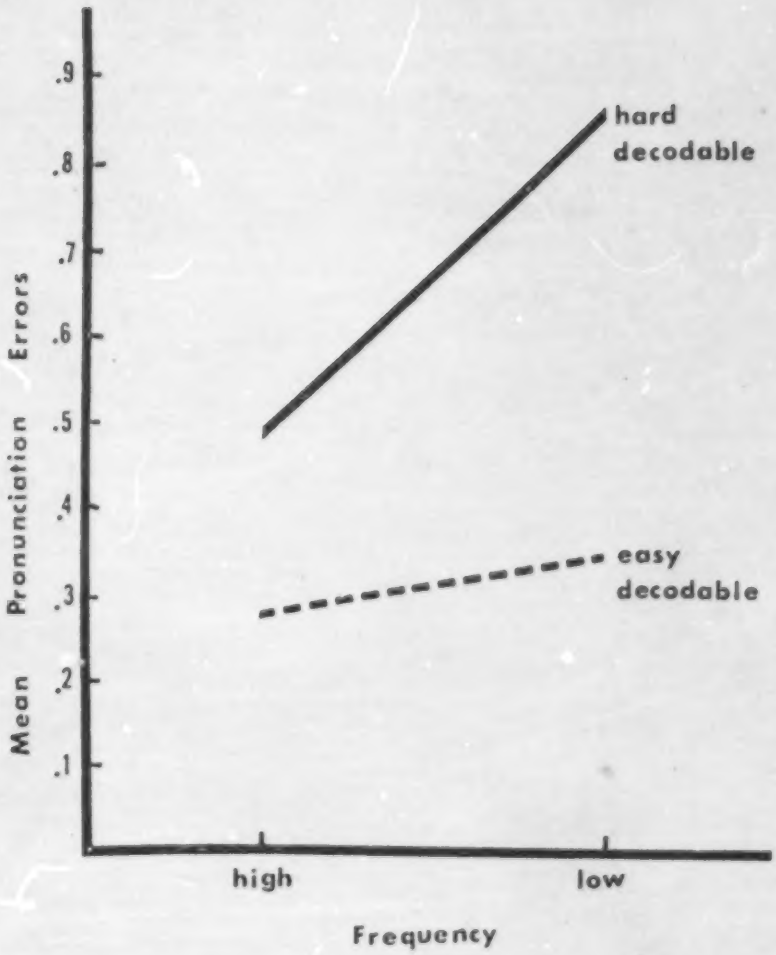
TEXT
SENTENCE COMPREHENSION PROCESS
Affected by: Reversibility
Length
Measured by: Understanding Errors
Reading Time




.9
.8
.7
.6
.5
.4
.3
.2
.1
Mean Pronunciation Errors
hard decodable
low frequency
high frequency
easy decodable
one
two
Syllables


.9
.8
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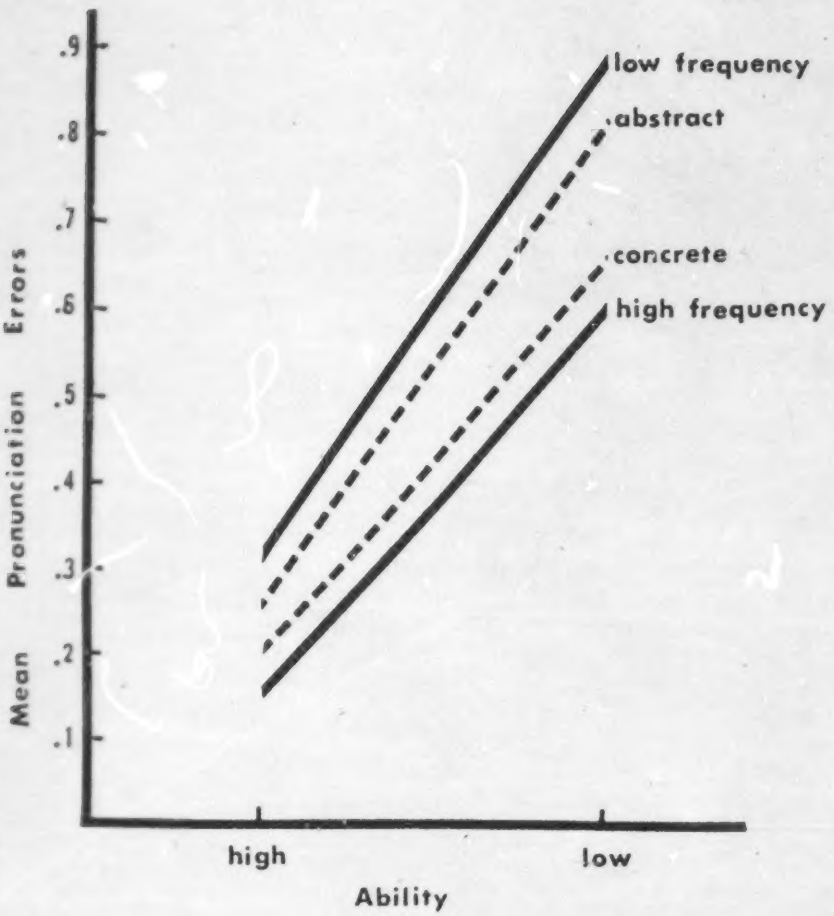
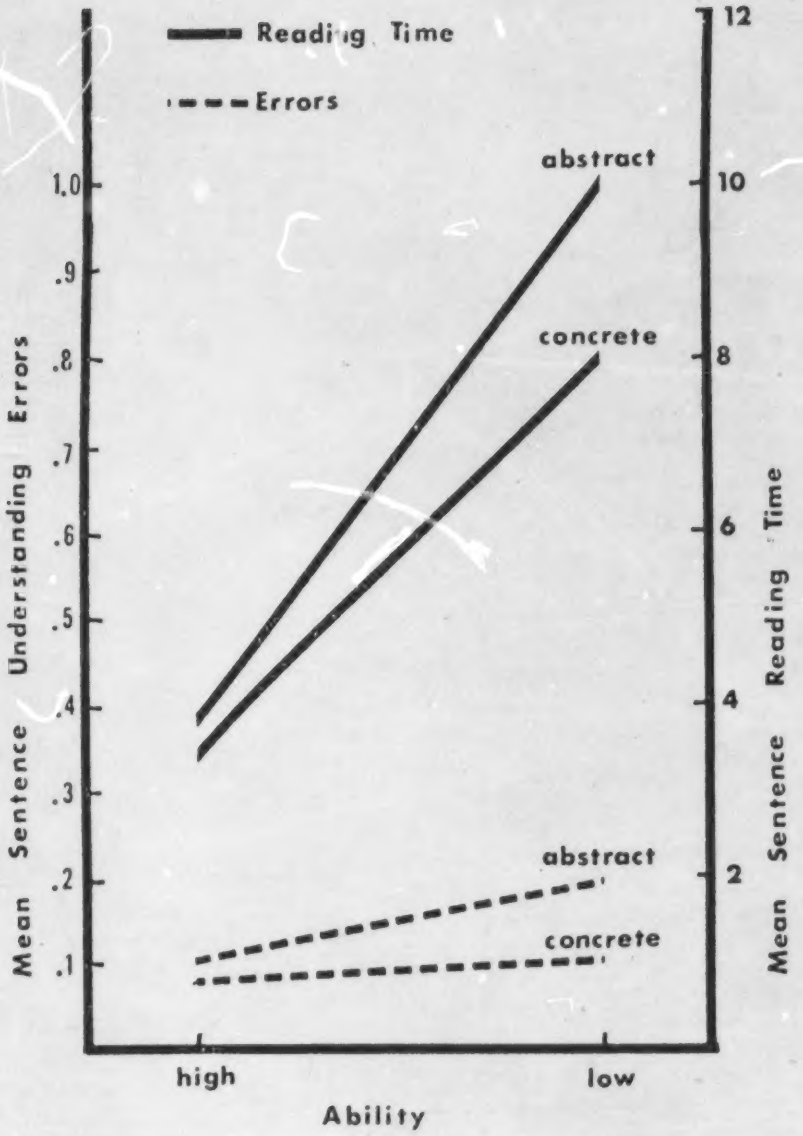
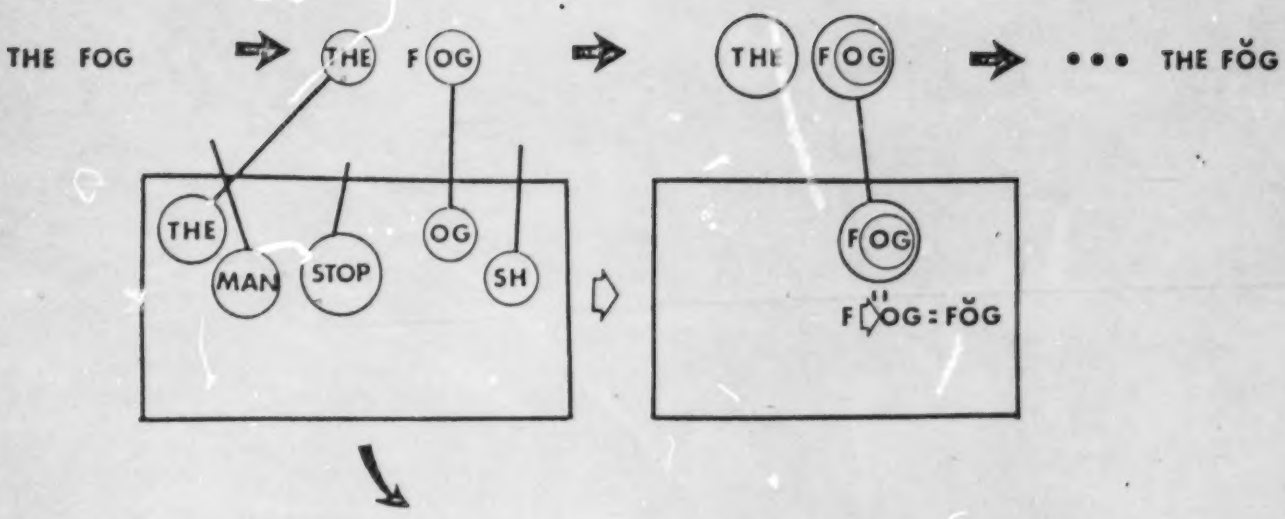
.6
.5
.4
.3
.2
.1
Mean Pronunciation Errors
hard
decodable
easy
decodable
high
low
Frequency


.9
.8
.7
.6
.5
.4
.3
.2
.1
Mean Pronunciation Errors
low frequency
abstract
concrete
high frequency
high
low
Ability


Reading Time
Errors
abstract
concrete
abstract
concrete
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
12
10
8
6
4
2
high
low
Ability
Mean Sentence Understanding Errors
Mean Sentence Reading Time

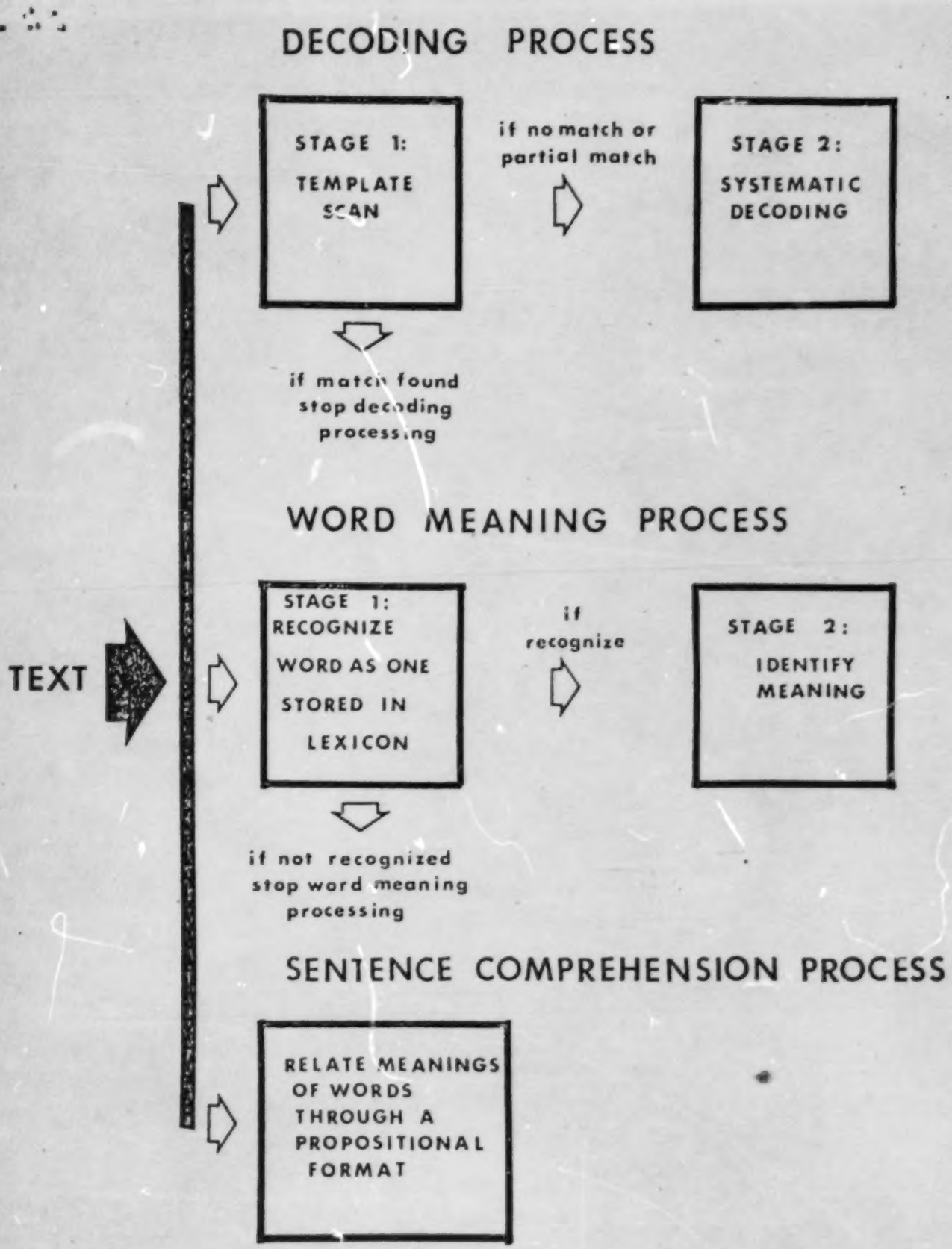


STAGE 1

TEMPLATE SCAN

STAGE 2

SYSTEMATIC DECODING


DECODING PROCESS
STAGE 1:
TEMPLATE
SCAN
if no match or
partial match
STAGE 2:
SYSTEMATIC
DECODING
if match found
stop decoding
processing
WORD MEANING PROCESS
TEXT
STAGE 1:
RECOGNIZE
WORD AS ONE
STORED IN
LEXICON
if
recognize
STAGE 2:
IDENTIFY
MEANING
if not recognized
stop word meaning
processing
SENTENCE COMPREHENSION PROCESS
RELATE MEANINGS
OF WORDS
THROUGH A
PROPOSITIONAL
FORMAT

Appendix

Experimental Sentences

Sentence Block 1, Replication 1

1. The bus hits the car.
2. The happy kid rides his bike down the road.
3. The full jug fills the mug with some water.
4. The mole digs the sod.
5. The little pet rubs the son on the leg.
6. The side wins the race.
7. The cad sees the mob.
8. The kind pal hides a sob with his hand.
9. The fat bear bites the wolf on the back.
10. The crown has a pearl.
11. The hound finds the grouse.
12. The happy choir rides a sleigh to the town.
13. The crowd finds the friend.
14. A big doubt fills his thought in the night.
15. The funny guise hides the fiend from the men.
16. The squall stops the drought.
17. The happy farmer finds the kitten in the barn.
18. The pilot takes the helmet.
19. The pinto sees the bobcat.
20. The happy miner plays a banjo for the children.
21. The device hits the human.
22. The good radar finds the orbit of the rocket.
23. The fast laser stops the rascal in the street.
24. The captor likes the kidnap.
25. The plateau hides the mountain.
26. The pretty flowers fill the meadow with much color.
27. The black leopard sees the ostrich on the hill.
28. The freighter pulls a dinghy.
29. The big creature sees the beauty in the house.
30. The patient has a disease.
31. The athlete hugs his girlfriend.
32. Her new glamour starts envy in the girls.

Sentence Block 2, Replication 1

1. The long bus hits the car in the street.
2. The kid rides his bike.
3. The jug fills the mug.
4. The small mole digs the sod on the hill.
5. The pet rubs the son.
6. The best side wins the race to the town.
7. The little cad sees the mob in the street.
8. The pal hides a sob.
9. The bear bites the wolf.
10. The pretty crown has a pearl on the top.
11. The fast hound finds the grouse in the grass.
12. The choir rides a sleigh.
13. The kind crowd finds the friend in the house.
14. A doubt fills his thought.
15. The guise hides the fiend.
16. The big squall stops the drought on the farm.

17. The farmer finds the kitten.
18. The tall pilot takes the helmet in his hand.
19. The pretty pinto sees the bobcat by the tree.
20. The miner plays a banjo.
21. The round device hits the human in the leg.
22. The radar finds the orbit.
23. The laser stops the rascal.
24. The fat captor likes the kidnap of the children.
25. The tall plateau hides the mountain from the boys.
26. The flowers fill the meadow.
27. The leopard sees the ostrich.
28. The long freighter pulls a dinghy in the water.
29. The creature sees the beauty.
30. The fat patient has a disease in his leg.
31. The big athlete hugs his girlfriend after the game.
32. Her glamour starts envy.

Sentence Block 1, Replication 2

1. The cub sees the dog.
2. The funny man pets the cat on the back.
3. The fat hog bites the ram in the leg.
4. The cop takes the dice.
5. The happy wife hugs her mate in the house.
6. The pit has a rim.
7. The bum hits the hag.
8. The funny rig makes a rut in the road.
9. The old cow finds the mouse in the barn.
10. The owl sees the field.
11. The launch hits the squid.
12. The light gauze rubs the bruise on his leg.
13. The pair see the prey.
14. The small group makes a choice about the food.
15. The small mount kicks the grouch with his leg.
16. The taunt starts a feud.
17. The big tiger sees the rabbit on the hill.
18. The garden has a cactus.
19. The beggar stops the robber.
20. The fat baker makes a muffin for the girl.
21. The winner sees the public.
22. The happy humor gives escape from the work.
23. The big goblin hits the miser with a bag.
24. The nomad sings a ballad.
25. The squirrel finds the rooster.
26. The fast airplane goes to the island for the man.
27. The big cougar bites the baboon in the tree.
28. The youngster does the laundry.
29. His funny trouble gets laughter from the children.
30. The daughter wants friendship.
31. The villain has a nightmare.
32. The funny mischief gets a chuckle from his father.

Sentence Block 2, Replication 2

1. The small cub sees the dog in the grass.
2. The man pets the cat.
3. The hog bites the ram.
4. The tall cop takes the dice from the man.
5. The wife hugs her mate.
6. The dark pit has a rim at the top.
7. The old bum hits the hag with a shoe.
8. The rig makes a rut.
9. The cow finds the mouse.
10. The small owl sees the field from his tree.
11. The small launch hits the squid in the water.
12. The gauze rubs the bruise.
13. The happy pair see the prey on the hill.
14. The group makes a choice.
15. The mount kicks the grouch.
16. The little taunt starts a feud with the boys.
17. The tiger sees the rabbit.
18. The pretty garden has a cactus in the back.
19. The old beggar stops the robber in the store.
20. The baker makes a muffin.
21. The tall winner sees the public after the race.
22. The humor gives escape.
23. The goblin hits the miser.
24. The happy nomad sings a ballad on the hill.
25. The little squirrel finds the rooster in the barn.
26. The airplane goes to the island.
27. The cougar bites the baboon.
28. The good youngster does the laundry for his mother.
29. His trouble gets laughter.
30. The little daughter wants friendship with some girls.
31. The bad villain has a nightmare in his sleep.
32. The mischief gets a chuckle.